Demonstration of the mapping of chromospheric magnetic fields by CLASP2.1

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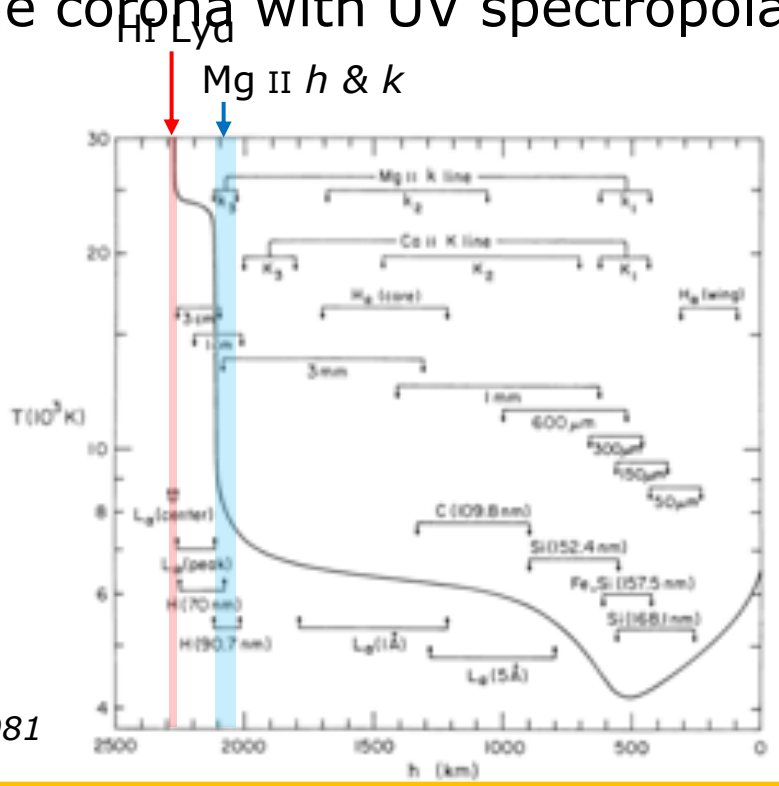
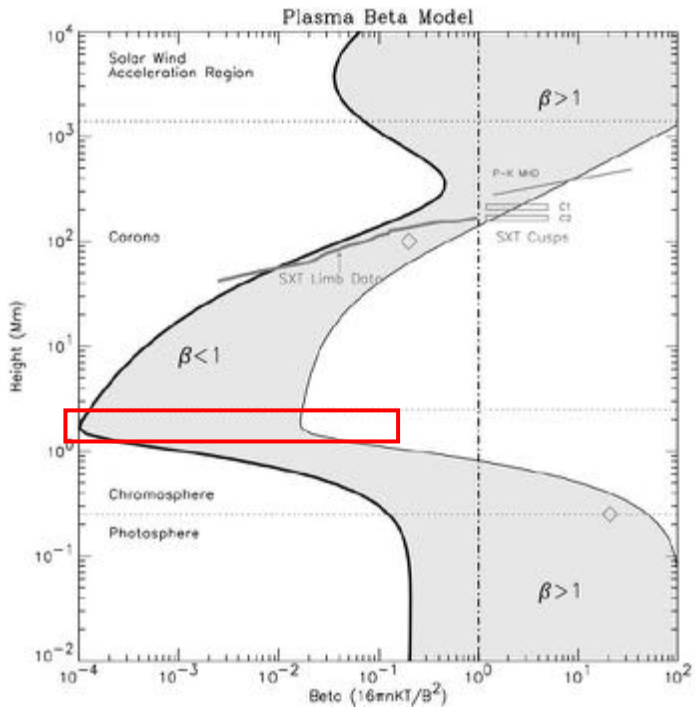
and CLASP2.1 team

Sounding Rocket Experiment CLASP Series

- Demonstration of diagnostic capability to measure magnetic fields at the base of the corona with UV spectropolarimetry



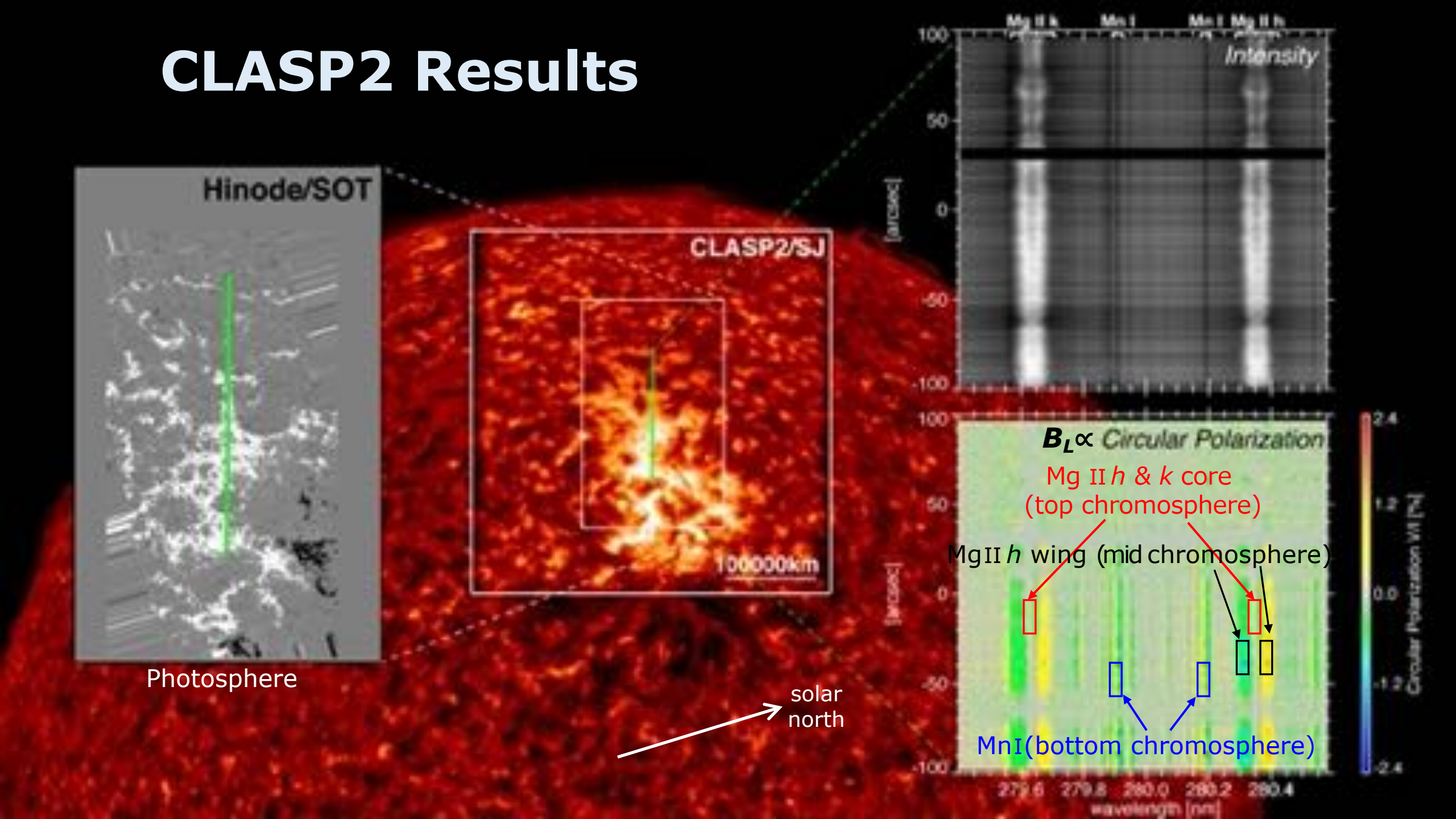
Vernazza+1981



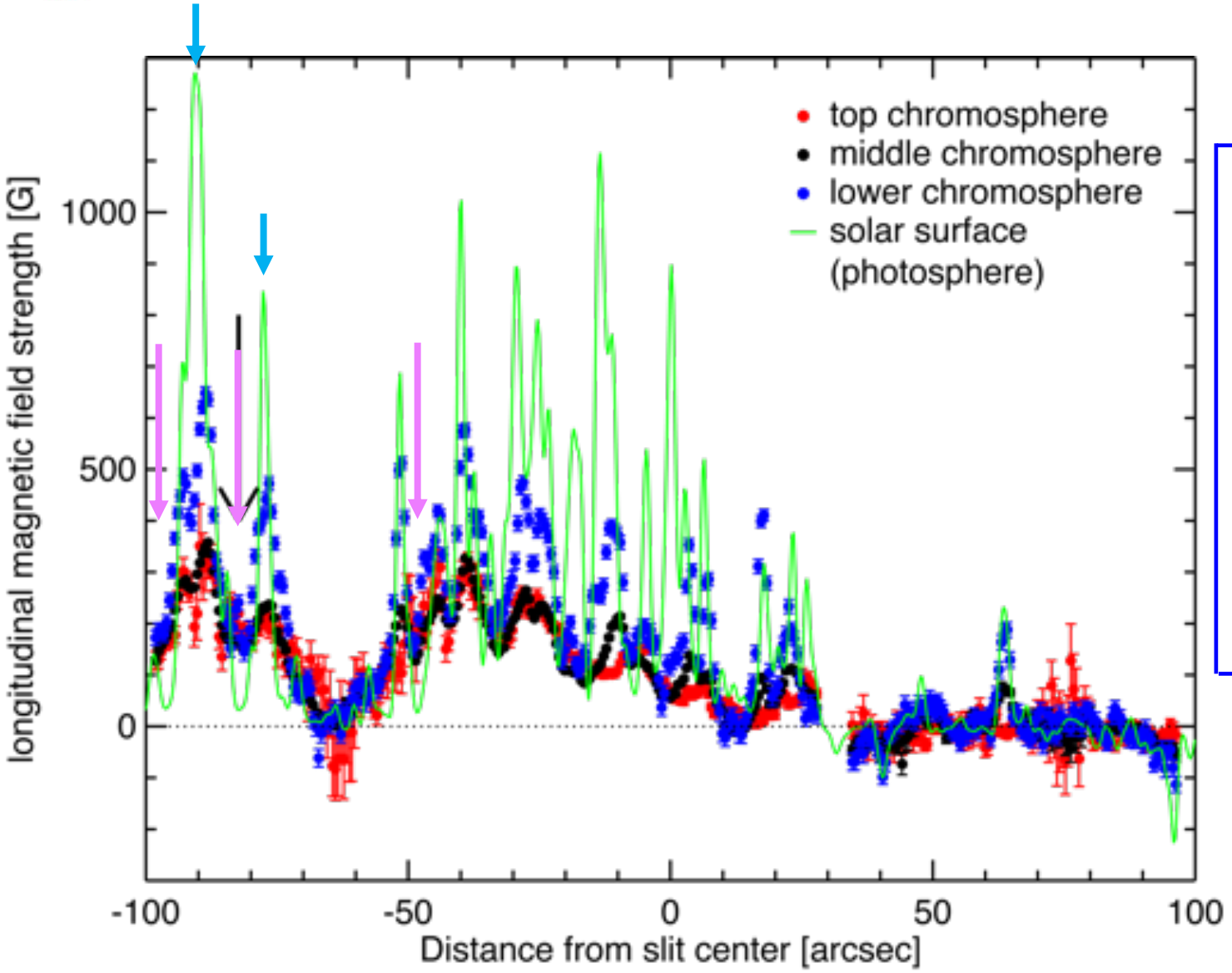
Gary 2001

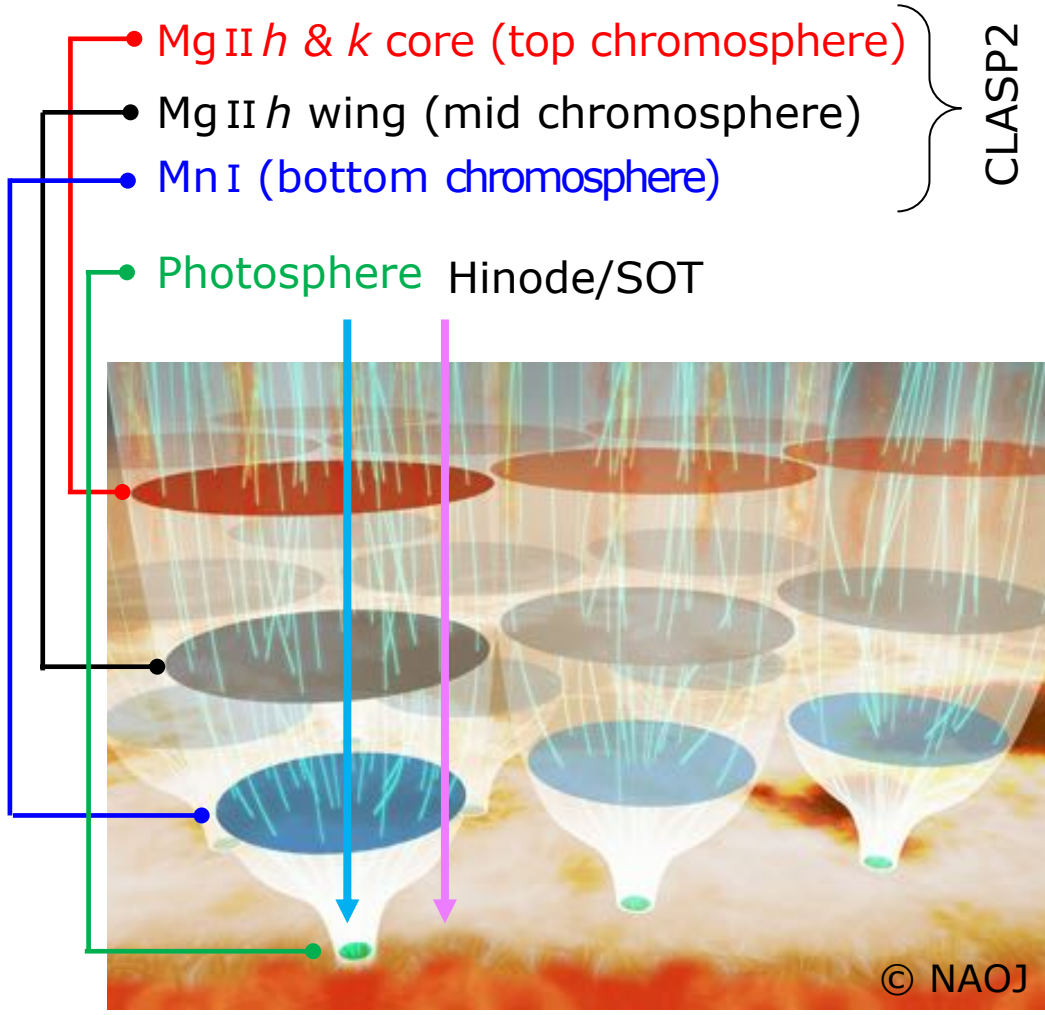
	Spectral line	Polarization	Target	Dimension
CLASP (2015)	Lya, Si III @ 121 nm	Linear (Q & U)	Disk center, QS	1D (sit & stare)
CLASP2 (2019)	Mg II *h* & *k*, Mn I @ 280 nm	Linear & **Circular (V)**	Disk center, QS, **Plage**	1D (sit & stare)
CLASP2.1 (2021)	Mg II *h* & *k*, Mn I @ 280 nm	Linear & **Circular (V)**	Disk center, **Plage**	**2D (scan)**

CLASP2 Results



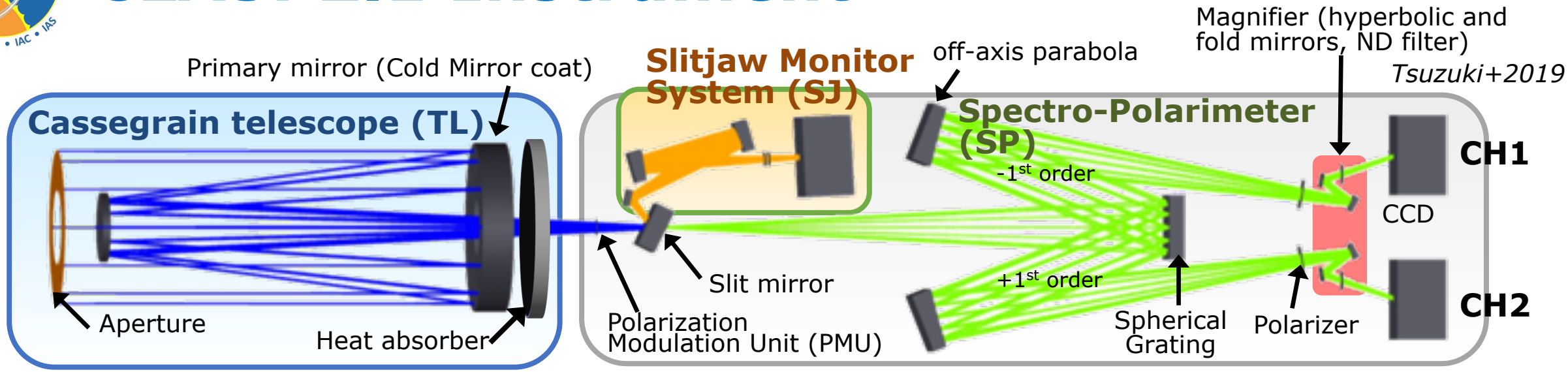
Expanding Flux Tube Revealed by CLASP2





Ishikawa+21

CLASP2.1 Instrument



- Reuse CLASP2 instrument without modification
  - Re-install Polarization Modulation Unit (PMU) and TL

Slitjaw Monitor System (SJ)

Wavelength	**Lya** (122nm) filter
FOV	527" x 527"
Resolution	**2"** (spatial)
Time cad.	0.6 sec

Spectro-Polarimeter (SP)

Wavelength	**Mg II *h* & *k*, Mn I** around 280 nm
FOV	**200"** (slit length)
Resolution	**1.1"** (spatial) & **0.01 nm** (wavelength)
Time cad.	3.2 sec for one PMU rotation

See Yoshida+2017, Song+2017 for alignment

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How to Ensure the Structural Soundness

- **Risk matrix**

Probability	Harm severity			
	Negligible	Marginal	Critical	Catastrophic
Certain	High	High	Very high	Very high
Likely	Medium	High	High	Very high
Possible	Low	Medium	High	Very high
Unlikely	Low	Medium	Medium	High
Rare	Low	Low	Medium	Medium
Eliminated	Eliminated			

2. Structure – b. Shock load

2. Structure – c. Cyclic fatigue
✓ Analysis of lifetime and visual inspection at WSMR → OK

2. Structure – d. Adhesive failure
✓ Visual inspection at WSMR → OK

2. Structure – a. Loose fasteners
✓ Check the fastening of the accessible & important screws (>100) at WSMR
→ Two screws on the main structure were found to be loosen and fastened again

1. Optics – a. Stress corrosion

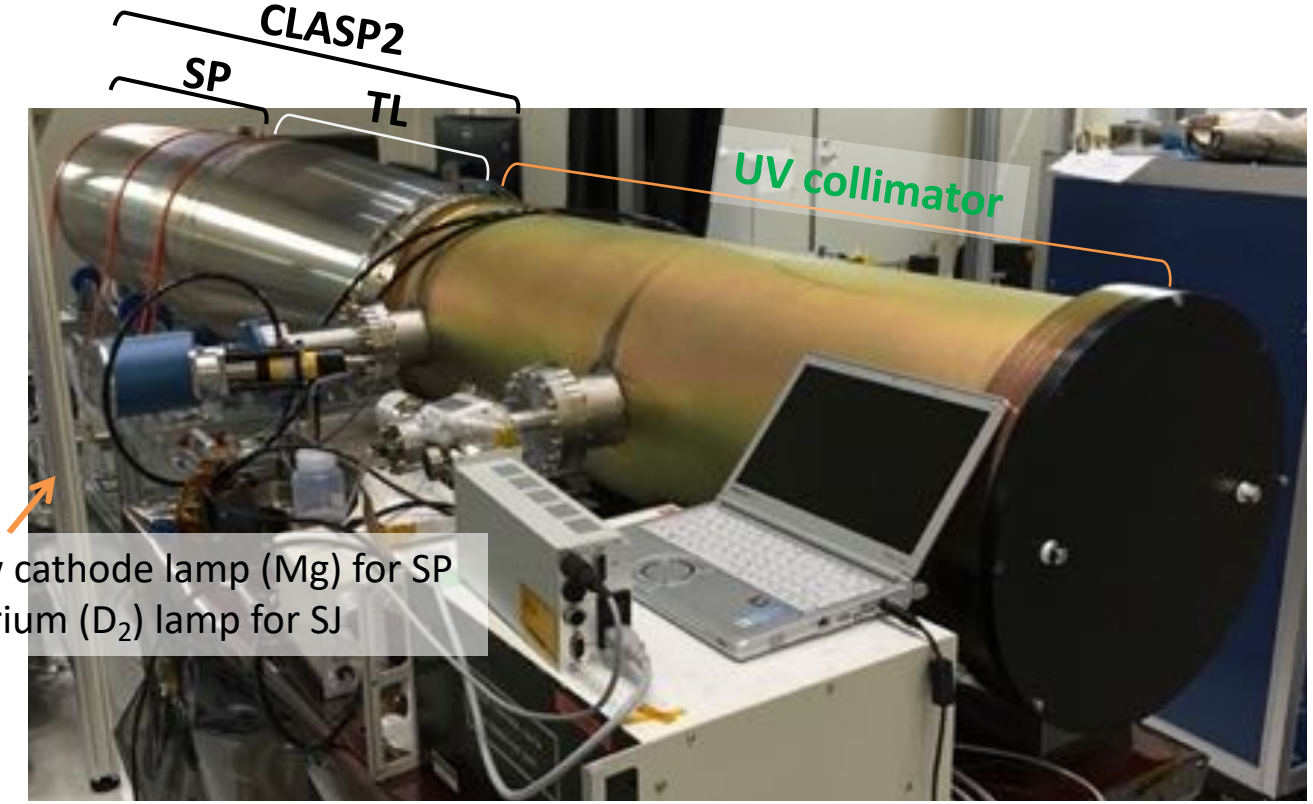
1. Optics – b. Cyclic fatigue

- Main structure and some optical components that had been used since CLASP
  - Three vibration tests (one at ISAS and two at WSMR) and two launchs
- Newly installed structure and optical components in CLASP2
  - Two vibration tests (one at JAXA and one at WSMR) and one launch

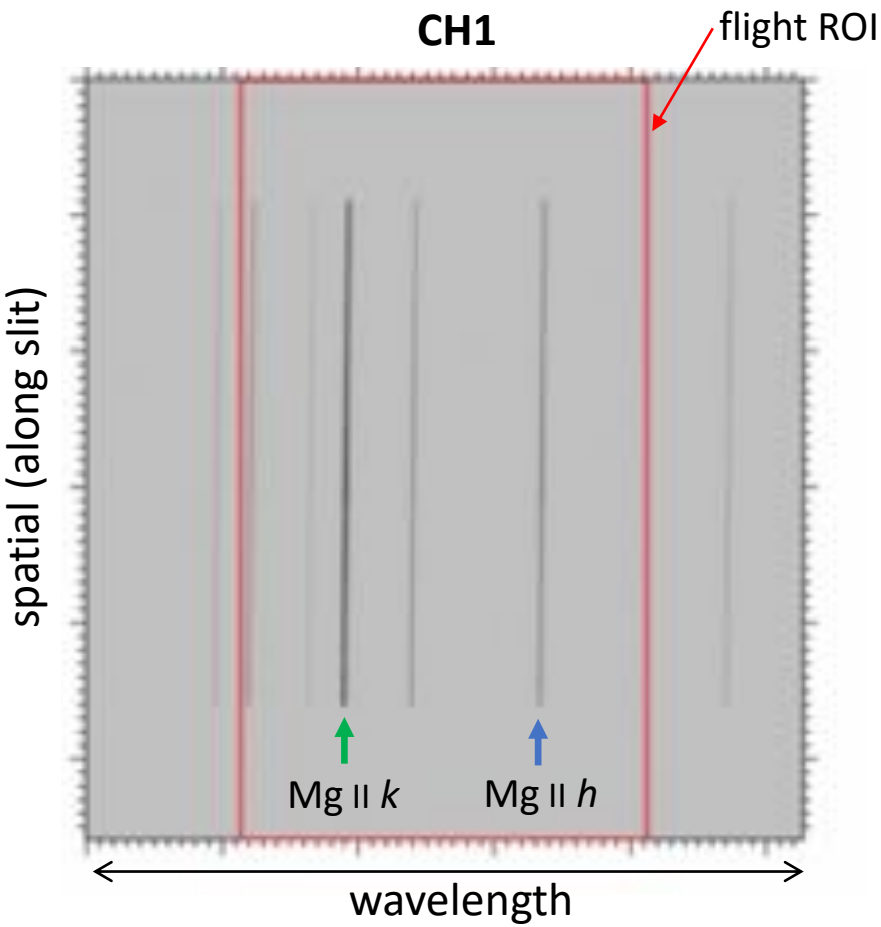
* WSMR = White Sands Missile Range in NW, USA

SJ, SP E2E tests & TL Focus Check

- Monitor the optical performance (resolutions and position) and the radiometry
  - Post-CLASP2 launch, post-transportation, post-vibration, post-CLASP2.1 launch

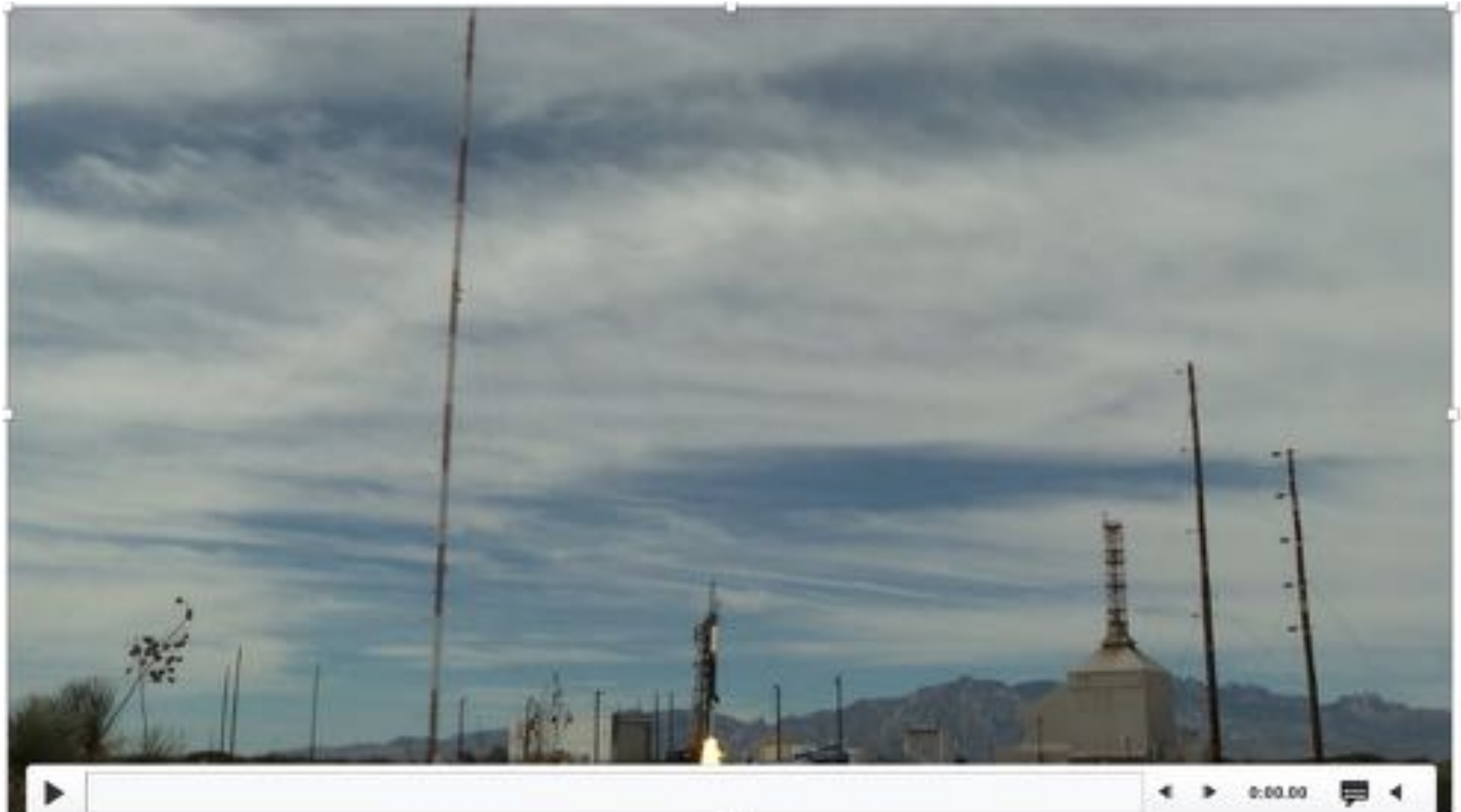


Configuration of E2E test



Launch on 2021.10.08 at 17:40 UT

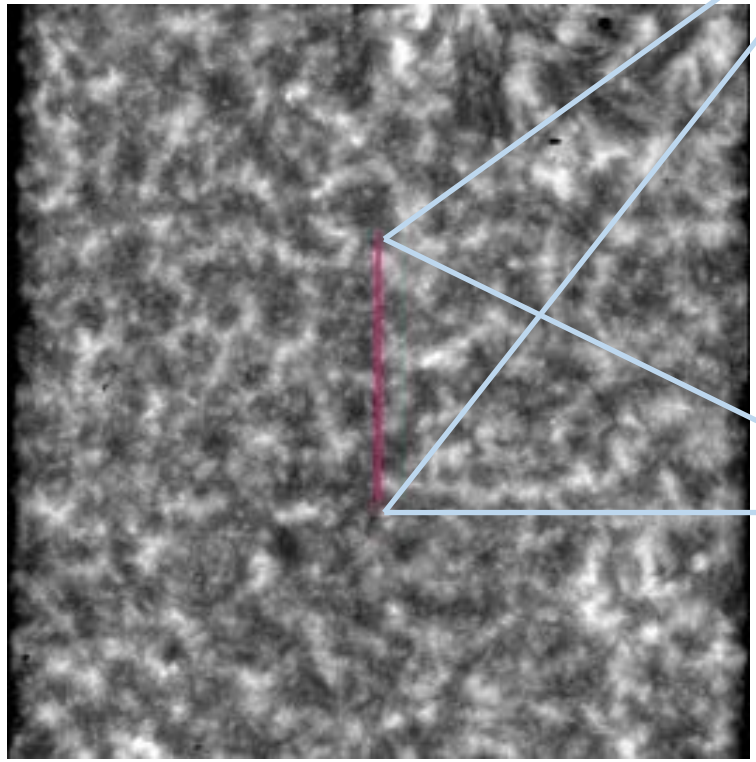
- Coordinated obsesrvtions with Hinode and IRIS
  - No data from Sac Peak and Big Bear due to the bad weather



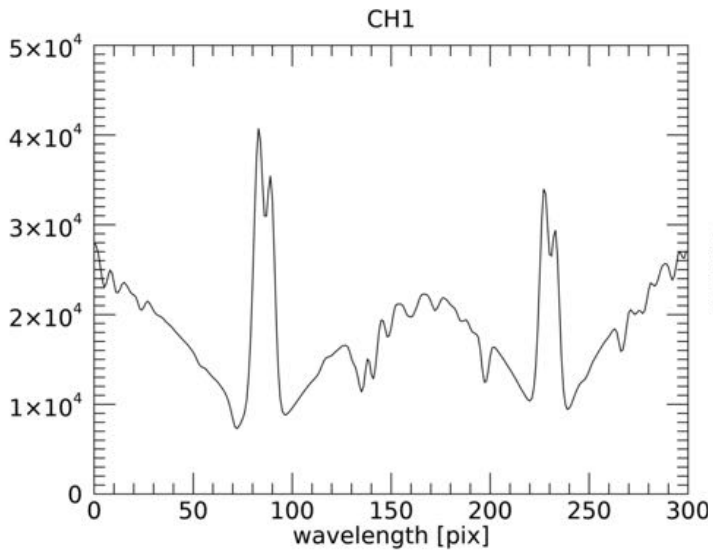
Disk Center Observation

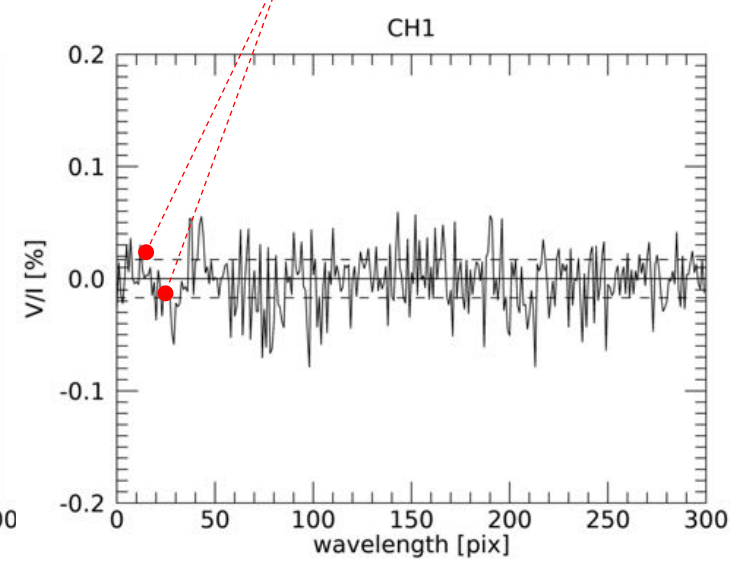
Requirement of ±0.017%. To be met by averaging along the wavelength

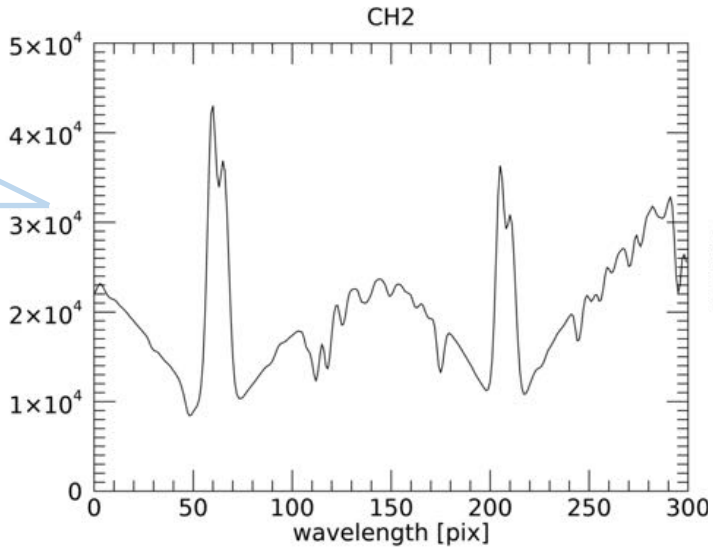
- Confirm that the instrumental polarization is negeligibly small
  - Averaging demodulated signals temporally (16 sec) & spatially (200”)

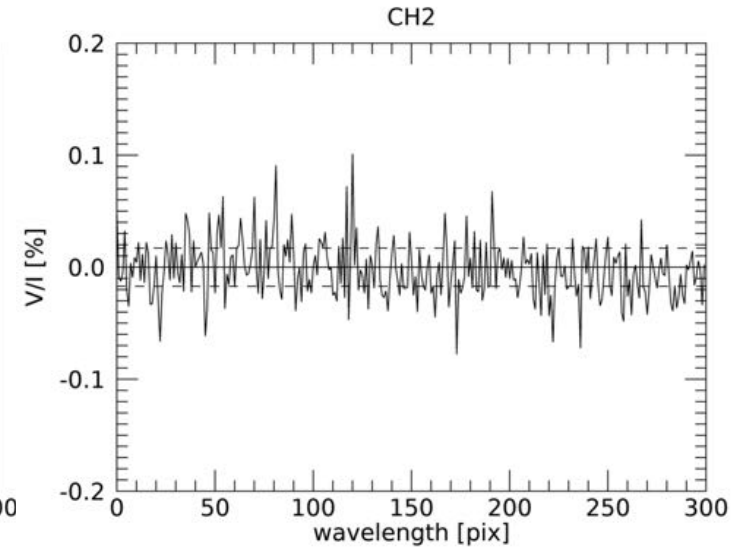


CLASP2.1/SJ

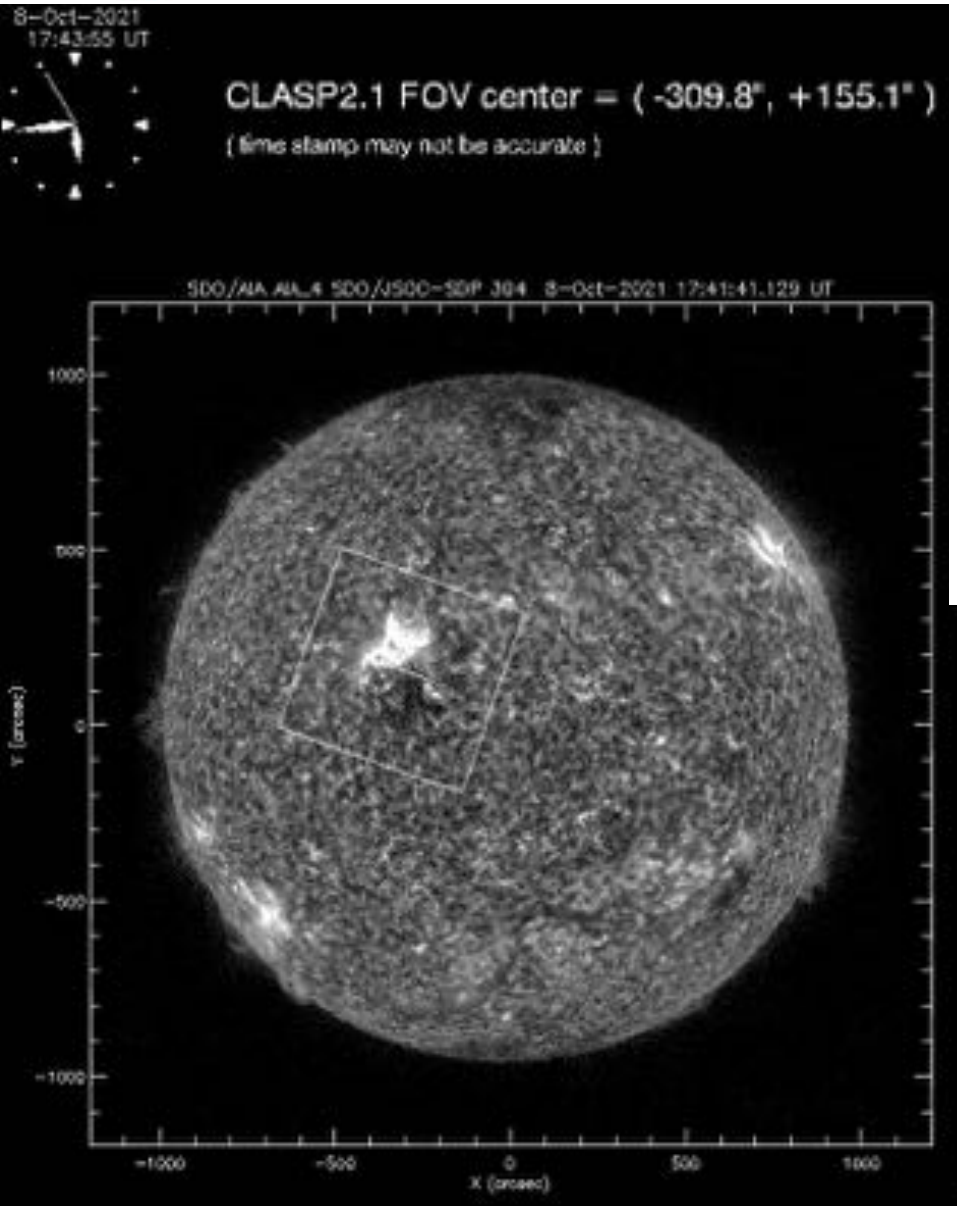




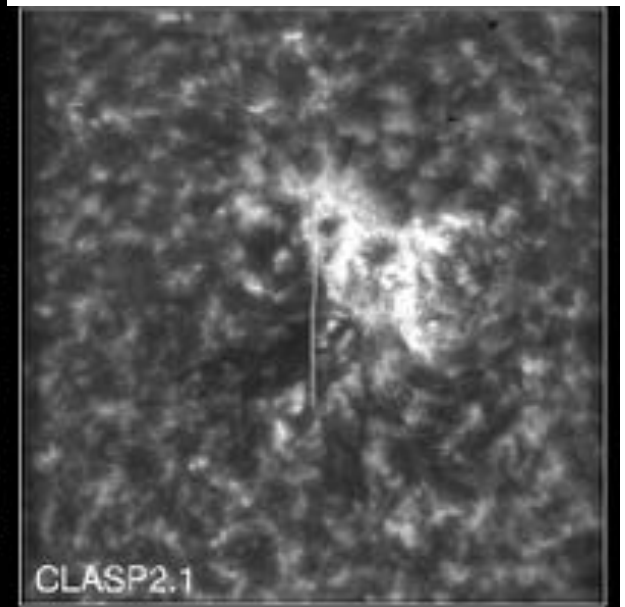




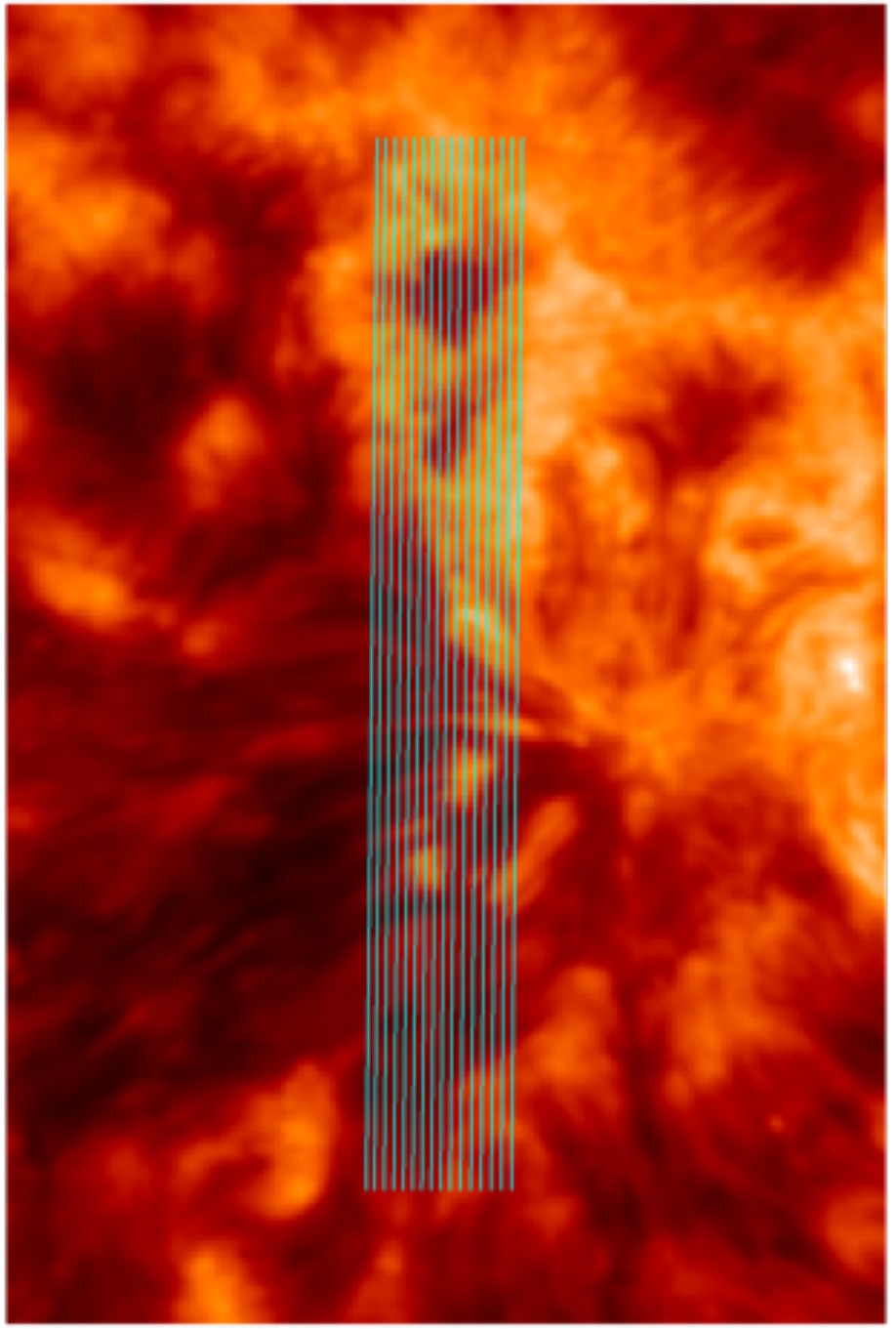
Plage observations



- Suceeded in scan with very stable pointing
- 16 steps with 1.7” gap (26” x 200”)

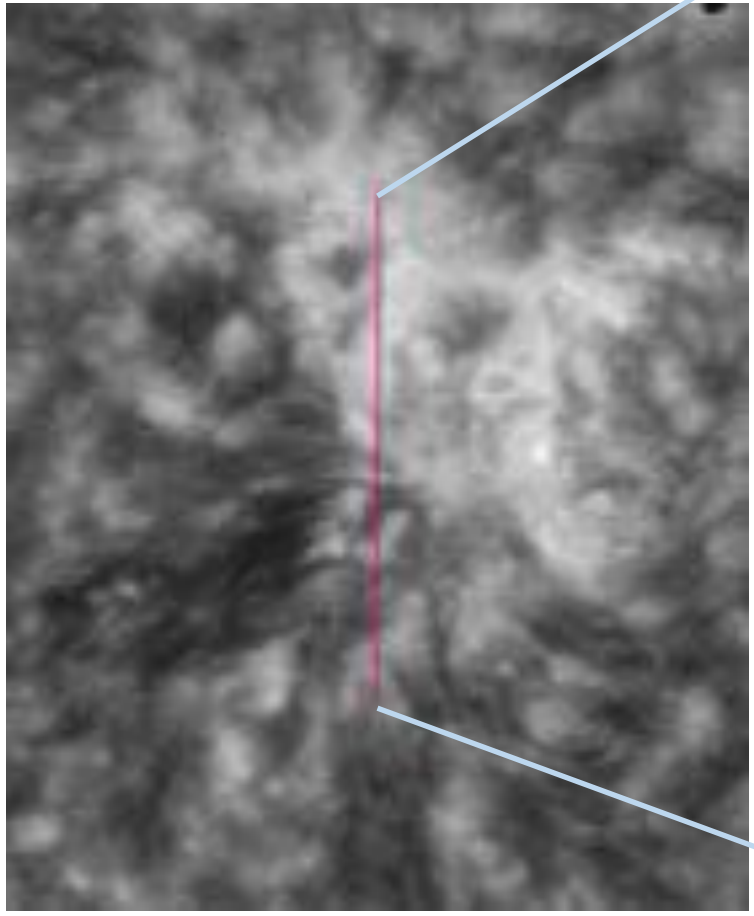


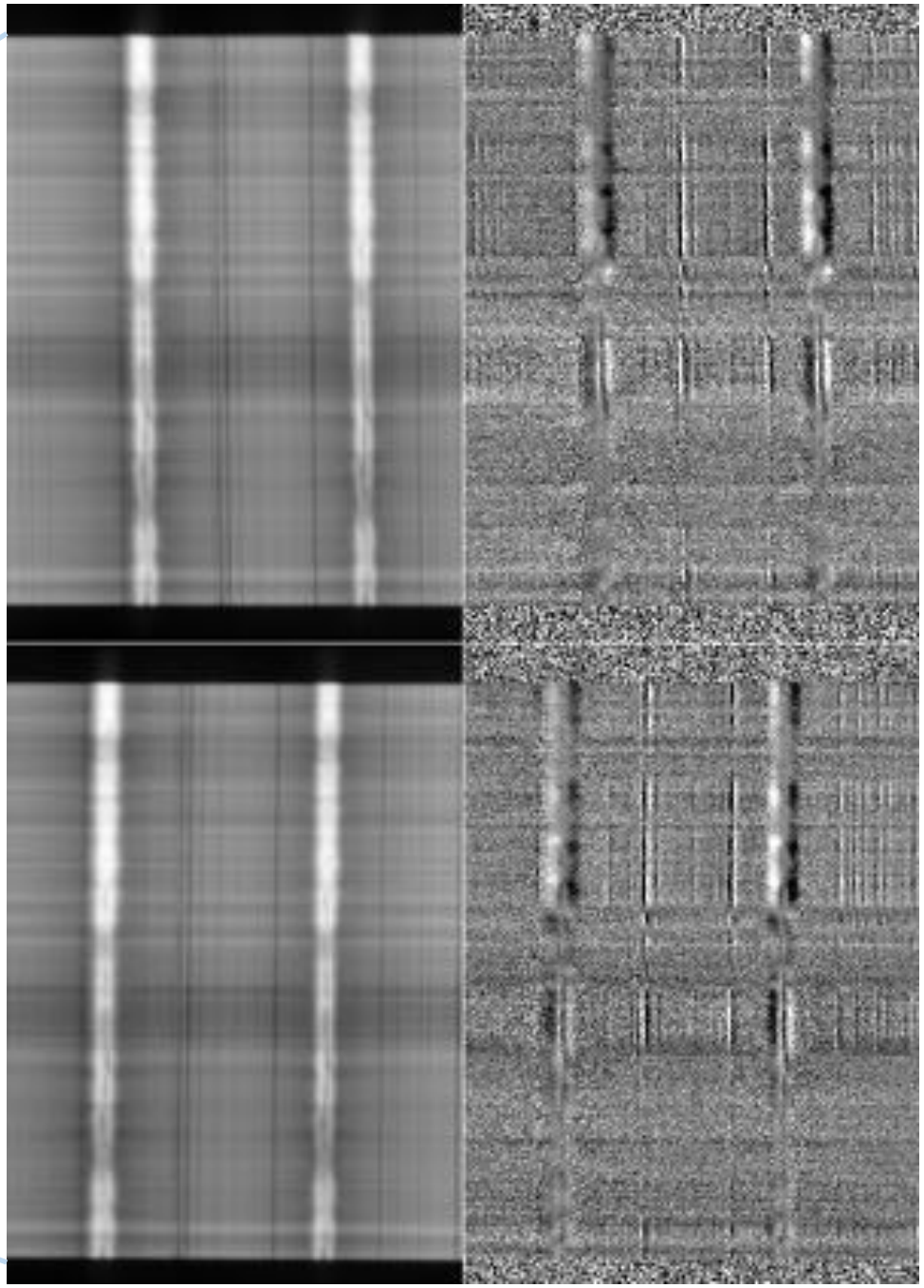
CLASP2.1/SJ (enlarged)



Polarization Spectra

- Data were successfully recorded for 17.6 sec (> requirement: 16 sec) at each scan





Two channels have to be combined to minimize the intensity induced polarization

Summary

- CLASP2.1 suceeded in the scan observation over the plage region to obtain the polarization spectra acrossing the Mg II *h* & *k* lines (280 nm)
  - Optical performance and polarization properties are equivalent to that of CLASP2
  - Circular polarization induced by Zeeman effeect in the MgII *h* & *k* and MnI lines
  - Date calibration is on-going for the science analysis
- Variety of circular polarization spectra
  - Reveal the 3D structure of the magnetic field by combinding with Hinode, SDO and IRIS data